

Technical Report 665

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Impact of Delayed Entry Program Participation on First Term Attrition

Alex G. Manganaris and Edward J. Schmitz

**Manpower and Personnel Policy Research Group
Manpower and Personnel Research Laboratory**



U. S. Army

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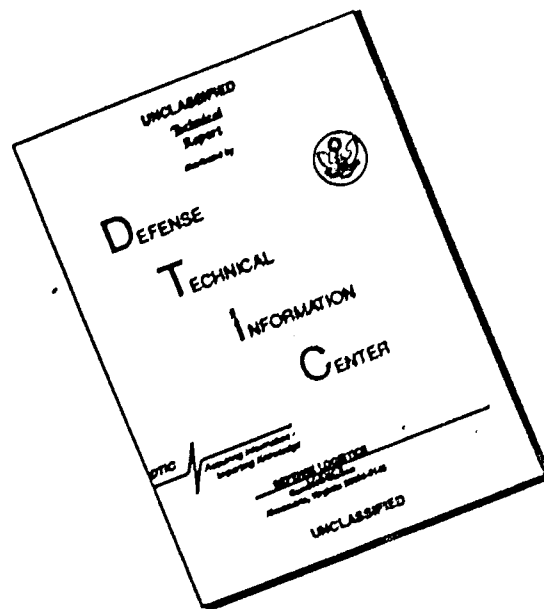
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This research analyzes the impact of Delayed Entry Program (DEP) participation on attrition in the first term. Using logistic regression, equations were estimated to determine the probability of attrition in 13 Army jobs. Independent variables used in this analysis were education, time in DEP, gender, race/ethnic background, and Armed Forces Qualification Test (AFQT) score. Results showed that in 9 of 13 equations the DEP had a significant impact on the probability of attrition. Results consistently showed that the longer individuals participate in the DEP the less likely they are to attrite in their first term. (cont)		

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FOREWORD

The Manpower Personnel Policy Research Group of the Army Research Institute for the Behavioral and Social Sciences (ARI) is concerned with developing better methods of allocating applicants to Army jobs to more efficiently utilize Army personnel resources. This research is another step in the ongoing process of investigating the various tradeoffs involved in policies affecting the allocation of personnel to jobs. Measuring the impact of various policies and incentives on in-service behavior may lead to improvements on how Army personnel resources are managed.



EDGAR M. JOHNSON
Technical Director

IMPACT OF DELAYED ENTRY PROGRAM PARTICIPATION ON FIRST TERM ATTRITION

EXECUTIVE SUMMARY

Requirement:

To determine the effect of Delayed Entry Program (DEP) participation on first term attrition within different Military Occupational Specialties (MOS).

Procedure:

Using a logistic regression procedure and microdata, equations for 13 MOS were estimated. Independent variables included gender, education, race/ethnic background, Armed Forces Qualification Test (AFQT) score, and time in the DEP.

Findings:

In 9 of the 13 MOS analyzed DEP participation has a significant effect on first term attrition. The greater the length of DEP participation the more likely an individual will complete their first term. High school graduates have lower attrition than non-high school graduates. Males have lower attrition than females. Blacks have lower attrition than whites. Higher AFQT individuals have lower attrition than lower AFQT individuals. Results were also sensitive to the particular MOS assignment.

Utilization of Findings:

MOS differences in results indicate that significant tradeoffs exist when allocating personnel across MOS. Recruiting policies such as the DEP have a significant effect on reducing attrition. Therefore, DEP participation should be maintained or increased, if possible.

IMPACT OF DELAYED ENTRY PROGRAM PARTICIPATION ON FIRST TERM ATTRITION

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I. INTRODUCTION

The delayed entry program is an important recruiting policy tool. It allows an individual to delay up to twelve months between signing a contract and becoming an accession. The DEP is used to provide a way for an individual to enlist in a desired occupation (MOS) reserving a slot at the time a contract is signed. The DEP also allows the Army flexibility in managing the flow of recruits into training courses.

This research is an examination of enlisted personnel attrition. The purpose of this analysis is to understand better the relationship between individual characteristics, Army policies and first term attrition of enlisted personnel.

Two important aspects of this work are that it controls for both the individual's job assignment (allocation Policy) and the length of time one stays in the DEP (enlistment policy). Since both job assignment and DEP participation are policy variables, a greater understanding of their effects on attrition may benefit those who make enlistment/allocation policy. This research not only determines whether relationships exist between policies, individual characteristics and attrition, but also measures how a change in one affects the other. Therefore, this research has three broad objectives:

- o Identify the relationship between time in the DEP and first term attrition (Enlistment Policy).
- o Estimate the effects of various Military Occupational Specialty (MOS) assignments on attrition (Allocation Policy).
- o Show how demographic characteristics affect first term attrition (Behavioral Aspects).

Section II provides a brief review of relevant literature and an understanding of how this work relates to previous research. Section III defines the approach taken in this analysis. This section provides descriptions of the parameters used and the methodological approach. Section IV provides the results and section V discusses the results. The final section, VI examines the policy implications of the results, and also develops a plan for future research.

II. BACKGROUND

Attrition is an important part of military manpower and personnel planning. Attrition is emphasized because it is very costly. The Army spends considerable resources in recruiting, training and paying an enlistee. When an individual leaves prematurely much of this investment is lost. Also, attrition has direct effects on force structure and readiness. Turnover of individual soldiers will reduce the proficiency of the unit (Sorley, 1980).

Much of the previous behavioral research has been concerned with understanding "who" will be more likely to leave prematurely. Examples of this kind of research may be found in work by Goodstadt and Yedlin (1980) and Guthrie, Lakota and Matlock (1978). A thorough literature review can be found in work by Wiskoff, Atwater and Houle (1980). Much of this research has focused on "in service concerns". Few policy variables have been highlighted. Most of the variables used have been demographic and behavioral in nature. While many of the findings in this body of research have been enlightening, in actuality these results do not directly help decision makers to set policy.

Other research has examined effects of alternative enlistment and allocation policies. This may be termed policy research. Policy research provides decision makers with information on alternatives in allocating scarce resources. In personnel planning this resource is people. Behavioral research has identified categories of individuals who are preferred for recruiting. However, behavioral research has not actually tried to measure the effects of changing a particular parameter. While knowing that non-high school graduates are more likely to leave prematurely is important, some measure of how a ten percent increase in non-high school graduates will affect the attrition level in a particular MOS may be more important. The force cannot be manned by just one characteristic group. Therefore, the problem facing decision makers and researchers is understanding the tradeoffs involved in allocating the more preferred and less preferred individuals to the many military occupations.

Stokey and Zeckhauser suggest that policy research fits into a five-part framework (1978, page 5):

- o Establishing the Context. What is the problem? What are the objectives?
- o Laying Out the Alternatives. What are the alternatives? What are the possibilities for gathering information?
- o Predicting the Consequences. What are the consequences of each alternative. What are the appropriate techniques for prediction? If outcomes are uncertain what is the likelihood of each?
- o Valuing the Outcomes. By what criteria should we measure success in pursuing objectives? How should different combinations of objectives be compared to one another?
- o Making a Choice. What is the preferred course of action?

This research will try to "predict the consequences" of assigning people, based upon certain policies, to various jobs. While conclusions made from this research will be stated broadly, specifics can be determined and examples with shown.

Manganaris and Schmitz (1984) projected attrition rates for 76 MOS by sex, Armed Forces Qualification Test (AFQT) group, and education. The authors described MOS as an organizational variable, meaning that it represents much of the actual military experiences described by, quality of life, type of work and organizational climate. Gender, AFQT group and education were parameters that represented various characteristics of the individual. Also all variables used in this analysis are available at the time of enlistment. Their model predicted the rate of attrition as a function of both individual and organizational characteristics. The results showed that:

- o Historical attrition can be explained as a function of identifiable organizational and individual characteristics.
- o There exists interaction between organizational and individual factors (MOS and education).
- o Variation in attrition rates is sizable, ranging from 12 to 64 percent, depending on the MOS and the individual's gender, AFQT and education. Also, 67 of the 76 MOS used in the analysis showed more than a 20 percent variation in attrition, depending on the type of individual assigned.

Buddin examined post-training attrition for the Army and Air Force, using the fiscal year 1975 cohort of enlisted personnel. This research also explored organizational and individual factors. "Military environment" was represented by MOS, duty location assignments and participation in the delayed entry program (Buddin 1981 page v). Aspects of the individual were represented by the recruit's region of origin, age, education, race, mental aptitude and family status (marital status and the number of dependents).

Using a logistic model Buddin showed that:

- o Army recruits who enter before age 18 have a 5 to 7 percent higher post training attrition rate.
- o Recruits without high school diplomas are 10 percent more likely to discharge early than are high school graduates.
- o Attrition rates do not vary significantly by race in most occupational areas. However, blacks have lower attrition (4 percent) in Army combat arms MOS.
- o AFQT Category was not shown to be significant all other things held constant. (Except in the Army combat arms MOS where lower mental categories have higher attrition rates.)
- o Married recruits are 3 to 8 percent less likely to leave prematurely. (This does not hold true when the recruit is a parent.)

Post training attrition varies depending on duty location. MOS assignments produced different results. In combat jobs, MOS did not significantly affect attrition. In other types of jobs "specific occupational assignment will significantly influence" the probability of attrition (Buddin 1981 page 32).

In terms of the delayed entry program, Buddin found that DEP participants have a 5 to 10 percent lower attrition probability than nonparticipants.

Research by Baldwin at West Point, Army Center for Economic and Manpower Research, has shown that the DEP has a strong effect on first term attrition. Baldwin used a "survival" model in estimating attrition (Baldwin, Daula, and Fagan 1981 page 23). Using a Weibull distribution, Baldwin estimated the

probable time to "failure" (attrition) as a function of education, AFQT scores, race, DEP, state unemployment rate at time of accession, MOS, time between school and enlistment, bonuses, term on enlistment and gender. The advantage of survival analysis is that it estimates the probable time to attrition, rather than the probability of attrition, based on the effects of various parameters. Therefore, predictions can be made as to the expected cost of attrition, since the cost varies according to when the attrition occurs. Baldwin showed that:

- o High school graduates and those with higher ASVAB scores stay longer in their first term.
- o All other things being equal, non-whites have a much longer survival time in all MOS analyzed.
- o There are differences in the expected survival of enlistees depending on the cohort year (1976, 1977 and 1978).
- o Those that enter the DEP had a longer survival time. (Ranging from about 1 to 4 months in a three year term).
- o The higher the rate of unemployment in the recruits home state, the longer the survival time. (However, this term was not always significant and consistent)
- o There were considerable survival time differences across the five MOS examined.
- o The greater the time between high school and enlistment the shorter the expected survival time.
- o Bonuses had no significant effect on survival (although there may be an indirect effect).
- o Those who enlisted for longer tours, where bonuses are usually offered, have a longer survival time.
- o Females have a shorter survival time.

In this kind of research it is important to distinguish between those parameters that are "informational" and those that are directly of a policy nature. While some of the above findings have direct policy implications, others do not. For example, unemployment is not a factor that can be controlled by the Army. However, the Army may initiate a change in, say,

educational benefits to offset the changes that have occurred to the level of unemployment. On the other hand, the DEP is a parameter that the Army can directly influence.

Research by Flyer and Elster (1983) also examined time in the DEP on first term attrition. The results show that recruits who enter the service after a "significant" period of time in the DEP have lower attrition rates compared to direct ship enlistees (Flyer and Elster 1983 page 70). This relationship held true for both high school graduates and non-graduates. Also, attrition was more sensitive to time in DEP for males than females.

Other research findings were as follows (Flyer and Elster 1983 page 66):

- o High school graduates are more likely to complete their active duty tours than non-graduates.
- o AFQT varies as an accurate predictor of attrition. It has less of an effect for non-high school graduates and blacks.
- o Being married at the time of enlistment is predictive of higher attrition for three of the four services. (Marital status was not found to be a significant determinant of the rate of attrition among Air Force enlistees that are high school graduates.)
- o Black male enlistees have higher attrition rates than non-blacks after controlling for AFQT scores and education level. Exceptions occur for the Army and those that have the lowest acceptable AFQT scores for service entry. Black women experience lower attrition than women who are not black.
- o Women are more likely to attrit than men.
- o 17 year olds have higher attrition rates than those 18 or 19 years of age. Differences in the attrition rates by age vary not only by sex but by service and educational level.
- o Attrition rates vary considerably among recruits when they are grouped by home state at the time of enlistment.

III. APPROACH

This research was performed in the following steps:

- o Identify factors that relate to attrition.
- o Collect data that permits a detailed analysis of attrition rates.

- o Estimate parameters of the attrition model.
- o Investigate and interpret the significance of the model parameters for personnel policy.

The remainder of this section discusses the first three steps , while the following two sections discuss the implications of these findings.

This research explores attrition at the two year point. Attrition is defined as a rate: the probability that a person with certain attributes will separate prematurely. A microdata base was developed from the fiscal year 1981 Defense Manpower Data Center cohort file.

TABLE 1
MOS USED IN ANALYSIS

MOS	DESCRIPTIVE TITLE	APTITUDE AREA SCORE	QUALIFYING SCORE	NUMBER OF CASES
05C	Radio Teletype Operator	SC	95	3,235
11B	Infantryman	CO	85	10,449
13B	Cannon Crewman	FA	85	4,081
16J	Defense Aquisition Radar Oper.	OF	95	536
31M	Multichannel Comm. Equip. Oper.	EL	95	1,662
64C	Motor Transport Operator	OF	95	3,628
67N	Utility Helicopter Repairer	MM	100	1,293
71L	Administrative Specialist	CL	95	3,076
76P	Material Control & Acct. Spec.	CL	90	4,612
76Y	Unit Supply Specialist	CL	95	3,606
91B	Medical Specialist	ST	95	2,450
94B	Food Service Specialist	OF	85	2,984
95B	Military Police	ST	100	2,770
TOTAL				40,776

The advantage of microdata is that it uses individual observations rather than grouping data into categories. Since the attrition decision is an individual one it is appropriate to analyze microdata. Also, individual observations increase the variation in the range of observation and provides for a more accurate estimate of parameters.

This database consists of Non Prior Service Army accessions who took versions 8, 9 or 10 of the Armed Services Vocational Aptitude Battery (ASVAB). (Earlier versions of the ASVAB were misnormed and therefore excluded from the analysis.) This database contained 87,084 observations, which represents 73 percent of fiscal year 1981 non prior service accessions. Nineteen variables were used in this data set. Appendix A lists the variables and the variable format of this database. MOS were selected that had over 500 observations and encompassed a wide variety of occupations. In the final analysis, 13 MOS are used which total 40,776 observations. These MOS are listed on Table 1. Appendix B contains descriptive statistics of the sample.

THE LOGIT MODEL

The attrition decision is dichotomous. An individual can either leave (1) or stay (0). This creates problems in using ordinary least squares to estimate attrition since the error term will be heteroscedastic and estimates are not constrained to be greater than zero and less than one. The logit model can be used to overcome these deficiencies. The logit model is derived from the cumulative logistic function and can be expressed as follows (Pindyck and Rubinfeld 1981 page 287):

$$(1) P_i = F(Z_i) = F(a + Bx_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(a + Bx_i)}}$$

Where:

- P_i = cumulative probability of attrition
- e = the base of the natural logarithm
- a = intercept
- B = coefficients for x_i

While the logit model was used to estimate final model parameters, ordinary least squares was used to identify variables that were most significantly related with attrition. This approach is cost effective in terms of computing resources, and has been shown to produce consistent results (Amemiya, 1981). The variables used in the logit analysis can be seen in Table 2.

Since the effect of the delayed entry program is emphasized in this research Table 3 provides descriptive statistics of the DEP for each MOS analyzed in the 1981 cohort.

TABLE 2
LIST OF VARIABLES

DEPENDENT

Attrition (stat) - the stay/leave decision. 0 = remaining in the Army, reenlisting, going to officers school or completing required (contracted) length of service. 1 = leaving the service prematurely.

INDEPENDENT VARIABLES

Military Occupational

Specialty (MOS) - The job contracted for during enlistment. Also the job the enlistee trains for

Race - Dummy Variable. White is the reference group. R2 = Hispanic. R3 = Black

Sex (FMALE) - Males are the reference Group.

Black Female (BFMALE) - Variable showing behavioral differences between Black Females and all others (white females, black males, and white males)

Education - High School Graduate or better is the omitted category. NGRAD = non-high school graduate. GED = those with a Graduate Equivalency Diploma.

AFQT - Score received in Armed Forces Qualifying Test. Scores of 11 to 50 are treated as a base line. Scores of 51 to 99 are treated as a continuous variable.

TABLE 3

DELAYED ENTRY PROGRAM STATISTICS BY MOS

MOS	MEAN DEP TIME	STD. DEV.	% OVER 6 MONTHS
05C	2.1	2.1	9.9
11B	1.8	1.9	6.2
13B	2.0	2.0	8.1
16J	1.5	1.4	3.8
31M	1.8	1.7	5.5
64C	2.1	1.9	7.0
67N	3.1	2.5	19.6
71L	2.0	2.0	8.8
76P	2.6	2.4	16.0
76Y	1.9	1.9	7.7
91B	2.4	2.1	10.5
94B	1.6	1.7	4.6
95B	2.6	2.4	14.2

Other important variables were considered, such as enlistment option and bonus level, but not used. This is because the bonus and option data available were unreliably recorded in FY 1981 (Willis, 1984). This was most unfortunate, since enlistment option and bonus level may be important policy variables.

IV. RESULTS

This section will present a summary of the logit results for each MOS used in this analysis. Elasticities, level of elasticity significance and the logit r will be presented for each MOS. The logit r can be interpreted as the percentage of explained variation.

Elasticity of Attrition

An elasticity is a way that economists summarize how a change in one variable affects some other variable (Nicholson 1978). The elasticity of attrition (A) with respect to time in the DEP (D) is:

$$(2)E_{A,D} = \frac{\text{Percent change in attrition}}{\text{Percent change in DEP}} = \frac{A/A \Delta A}{D/D \Delta D}$$

What the above demonstrates is that as D changes so does A . This elasticity shows the percent change in the dependent variable (Attrition), for a one percent change in the independent variable (DEP). Each elasticity reported in this research shows the percentage change in attrition for a one percent change in the independent variable.

MOS 05C - Radio Teletype Operator

Table 4 shows the elasticities of the parameters included in the equation. All terms were significant at the .05% level, except the variable Black Females. The r for the logit was .251. Overall certain observations can be made. For example, a ten percent increase in average time in DEP is expected to produce a one percent decrease in attrition. Other variables with negative signs (decreasing attrition) are Hispanic, Black, Black Female and AFQT greater than 50.

Variables which have positive elasticities are Female (white and hispanic), non-graduates and GED. An interesting point is that while both non-graduates and GED have positive elasticities (positive relationship with attrition) compared to high school graduates, the attrition behavior of GEDs lies in between. This relationship continued throughout.

MOS 11B - Infantryman

This MOS had results which were similar to 05C except that there are less terms in the equation, since females are excluded from entering combat MOS. Also, by comparison, the absolute size of the elasticities are smaller with the exception of GEDs. All variables included in the equation were significant at the .001 level. The signs of the elasticities are in agreement with those found in MOS 05C.

MOS 13B - Cannon Crewman

The results found in the equation for this MOS were similar to those found in MOS 11B. The major difference was that DEP term was not significant. However the sign of the elasticity for DEP was in agreement with both 11B and 05C.

TABLE 4
ELASTICITIES OF MOS EQUATIONS

PARAMETER	05C	11B	13B	16J
AFQT 50	-.050* (4.34)	-.045** (13.13)	-.035* (6.35)	-.143* (3.89)
Black	-.116** (22.95)	-.055** (15.29)	-.122** (29.92)	-.047 (1.25)
Black/Female	-.006 (0.28)	-----	-----	.006 (0.24)
DEP in Months	-.095** (8.45)	-.052** (8.49)	-.023 (0.59)	-.101 (1.18)
Female	.129** (70.4)	-----	-----	.122** (21.77)
GED	.024** (15.25)	.038** (86.92)	.022** (13.74)	.084** (6.84)
Non-Graduate	.141** (98.59)	.124** (240.23)	.119** (89.36)	.101** (24.34)
Logit r	.251	.191	.194	.251

* - Significant at .05
** - Significant at .01
() - Chi square

MOS 16J - Defense Acquisition Radar Operator

The significant terms found in this logit equation were Female, non-graduate and AFQT greater than 50. The signs of all variables are in agreement with those observed in the previously analyzed MOS.

MOS 31M - Multichannel Communication Equipment Operator

Table 5 shows the elasticities for MOS 31M. All elasticities are significant except Hispanic, Black Female and GED. Again all elasticities have signs that are in agreement with the MOS addressed at this point. This MOS is very sensitive to changes in the proportion of females.

MOS 64C - Motor Transportation Operator

Table 5 shows the elasticities. All elasticities were found to be significant except Hispanic and Black/Females. Again the signs of the elasticities were in agreement with other MOS.

MOS 67N - Utility Helicopter Repairer

Table 5 shows the elasticities for MOS 67N. The r was .195. Two elasticities were found to be significant: DEP and non-graduates. Female and Black Female terms were excluded since there were few observations for females. All terms had signs in agreement with previous findings.

MOS 71L - Administrative Specialist

The elasticities for MOS 71L can be seen on Table 5. All but two of the elasticities were significant (Hispanic and GED). Females had a particularly large elasticity. Again all signs were in agreement with previous findings.

MOS 76P - Material Control and Accounting Specialist

The elasticities for MOS 76P can be seen on Table 6. Again GED and Hispanic were found not to be significant. All signs are in agreement with previous findings.

TABLE 5
ELASTICITIES OF MOS EQUATIONS

PARAMETER	31M	64C	67N	71L
AFQT 50	-.063* (4.74)	-.034* (6.13)	-.103 (2.20)	-.074** (11.17)
Black	-.129** (16.17)	-.064** (12.94)	-.025 (1.90)	-.146** (8.80)
Black/Female	-.0003 (0.00)	-.004 (0.61)	----	-.057 (2.23)
DEP in Months	-.119** (6.87)	-.070* (4.08)	-.258** (6.77)	-.070* (5.38)
Female	.201** (48.43)	.192** (119.68)	----	.364** (55.70)
GED	.017 (3.5)	.022* (8.07)	.026 (2.90)	.016* (6.06)
Non-Graduate	-.063* (4.74)	.107** (65.51)	.098** (25.34)	.023 (17.22)
Logit r	.234	.230	.195	.202

* - Significant at .05
 ** - Significant at .01
 () - Chi square

MOS 76Y - Unit Supply Specialist

Table 6 presents the elasticities. All parameters except DEP were found to be significant. All signs are in agreement with previous findings. Also, while DEP was not found to be significant at the .05 level, it was very close to being so.

TABLE 6
ELASTICITIES OF MOS EQUATIONS

PARAMETER	76P	76Y	91B	94B	95B
AFQT	-.018* (4.08)	-.043** (9.52)	-.104** (8.10)	-.018 (3.19)	-.164** (16.93)
Black	-.151** (11.98)	-.199** (35.49)	-.049 (3.36)	-.119** (30.10)	.008 (0.57)
Black/Female	-.056** (7.97)	-.037* (4.15)	-.042** (10.21)	-.009 (1.21)	.009* (5.78)
DEP in Months	-.081* (6.17)	-.060 (3.78)	-.099* (4.89)	-.036 (1.98)	-.100* (5.75)
Female	.210** (69.38)	.102** (19.92)	.146** (37.86)	.076** (29.80)	.106** (91.77)
GED	.012 (3.55)	.022** (11.52)	.025* (5.60)	.005 (0.49)	.022** (13.00)
Non-Graduate	.069** (66.47)	.107** (63.14)	.038** (20.75)	.129** (59.97)	.068** (60.81)
Logit r	.201	.213	.165	.192	.236

* - Significant at .05
 ** - Significant at .01
 () - Chi square

MOS 91B - Medical Specialist

Table 6 shows the elasticities and the chi-square values. Hispanic and Black are not found to be significant. Once again all signs are found to be in agreement with previous MOS results.

MOS 94B - Food Service Specialist

Table 6 shows the results. Only 3 elasticities were found to be significant: Black, Female, and non-graduates. All signs of the elasticities are in agreement.

MOS 95B - Military Police

Table 6 shows the results for Military Police. As can be seen Hispanic and Black are not significant. Also the parameter Black (not significant) has a sign that differs from prior findings. The elasticity for AFQT greater than 50 was the largest, in absolute terms, of all elasticities presented.

TABLE 7
RANGE OF ELASTICITIES (SIGNIFICANT)

PARAMETER	NUMBER OF TIMES SIGN.	MAX (ABS)	MIN (ABS)	MEAN
DEP MONTHS	9/13	.258	.052	-.185
HISPANIC	4/13	.031	.015	-.020
BLACK	9/13	.199	.055	-.122
FEMALE	10/10	.364	.076	.165
BLACK/FEMALE	4/10	.056	.009	-.036
NON-GRADUATE	13/13	.141	.023	.094
GED	9/13	.084	.016	.030
AFQT Greater than 50	11/13	.164	.018	-.070

Table 7 summarizes the elasticities. Both Female and Non-graduate elasticities were significant in all logit results where the variable was used. Also there was 100% agreement as to the direction of the signs of these two parameters. Hispanic and Black Female were significant the least amount of times.

Table 7 also shows the minimum, maximum and mean of the elasticities estimated from the logit equations.

V. DISCUSSION OF THE RESULTS

Figure 1 shows the relationship between time in the DEP, gender, education and AFQT score within MOS 31M-Multichannel Communications Operator. This graph shows that increased time in the DEP reduces the probability of attrition for all groups. The bottom line on Figure 1 (M.HS.85) shows the attrition curve for white male high school graduates with an AFQT score of 85. The next line (M.HS.50) shows the effect of reducing the AFQT score to 50. This shows that a reduction in AFQT score, all other things being equal, increases the probability of attrition by 6 percent at a DEP of 2 months. The third line from the bottom (M.NHS.85) holds everything constant except education. In this case it can be seen that a non high school graduate has a 14 percent higher probability of attrition at a DEP of 2 months. Finally, if sex is varied while education and AFQT score are held constant it can be seen that females (F.HS.85) have the highest probability of attrition (20 percent higher).

Figure 2 shows the attrition curves for the same groups in MOS 71L Administrative Specialist. As can be seen these lines are closer to horizontal implying that the DEP has less of an effect. Also while all the relationships between groups remain similar to those found in MOS 31M, non-graduates behave similarly to female graduates in MOS 71L. In other MOS (76Y, 91B and 94B) male non-graduates had higher attrition when compared to high school diploma females.

The Delayed Entry Program (DEP)

The results have shown that length of the DEP has a strong influence on attrition of enlisted personnel. As can be seen in both Figures 1 and 2, those immediately shipped have the greatest probability of attrition than those that DEP 9 months. The implication of this is that the DEP may serve as a motivational screening device. As early as the 1950's Air Force studies showed that individuals who were motivated enough to wait many months before entering the aviation cadet program were less likely to become losses than those entering immediately after becoming qualified for training (Flyer and Elster 1983 page 70).

FIGURE 1
PROBABILITY OF ATTRITION BY TIME IN DEP
MUS 31M

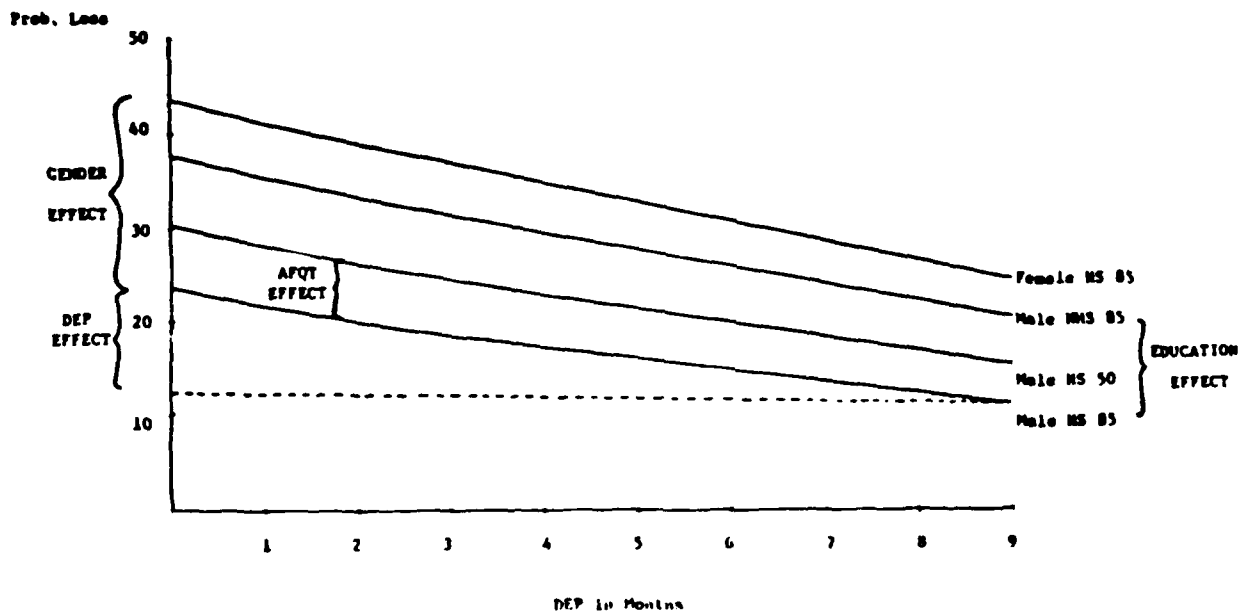
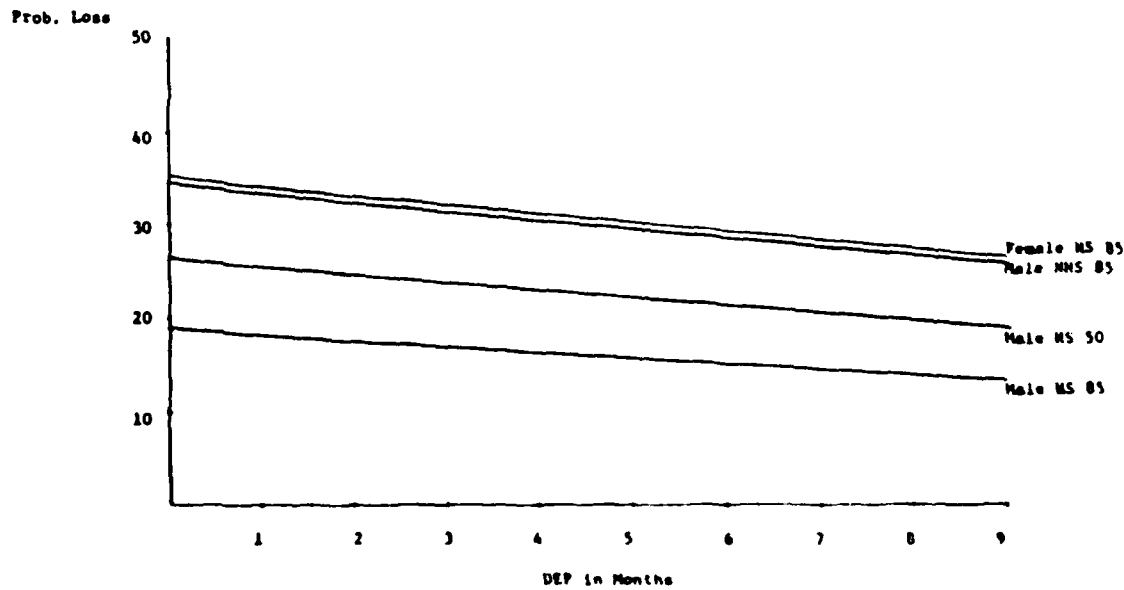


FIGURE 2
PROBABILITY OF ATTRITION BY TIME IN DEP
MOS 71L



Differences Among Military Occupational Specialty

Manganaris and Schmitz (1984) used MOS as a surrogate measure of organizational factors. MOS effects ranged approximately 43 percent depending on the MOS (Manganaris and Schmitz 1984 page 18). Figure 3 shows there are definite baseline differences in the probability of attrition among the 5 MOS examined. Besides baseline differences, the five MOS shown here have different sensitivity to changes in DEP length. MOS 31M and MOS 67N are very sensitive to changes in DEP length, while MOS 11B and MOS 13B are not. Although it would be preferable to compare results there are differences in model specification which make it difficult. Manganaris and Schmitz (1984) did not have DEP, Race or a GED educational category in the equation. However both results indicate that there are MOS differences in the rate, or probability of attrition.

TABLE 8

MOS ATTRITION PROBABILITY BY AFQT

White, Male, High School Graduate, DEP = 2 Months

<u>MOS</u>	<u>AFQT 50</u>	<u>AFQT 90</u>
05C	.246	.199
11B	.230	.186
13B	.266	.199
16J	.208	.119
31M	.262	.190
64C	.214	.148
67N	.159	.118
71L	.244	.116
76P	.213	.144
76Y	.288	.196
91B	.229	.163
94B	.335	.269
95B	.225	.140

AFQT Effects On Attrition

Table 8 shows the effect of AFQT score on first term attrition by MOS for a particular demographic group (white, male, high school graduate, DEP two months). Both scores fall under the broad category of I-III A, yet these groups exhibit very different attrition behavior. Other findings can be seen on this

FIGURE 3

PROBABILITY OF ATTRITION BY TECHNICAL AND NON-TECHNICAL MOS AND TIME IN DEP

White Male High School Graduate AFQT=60

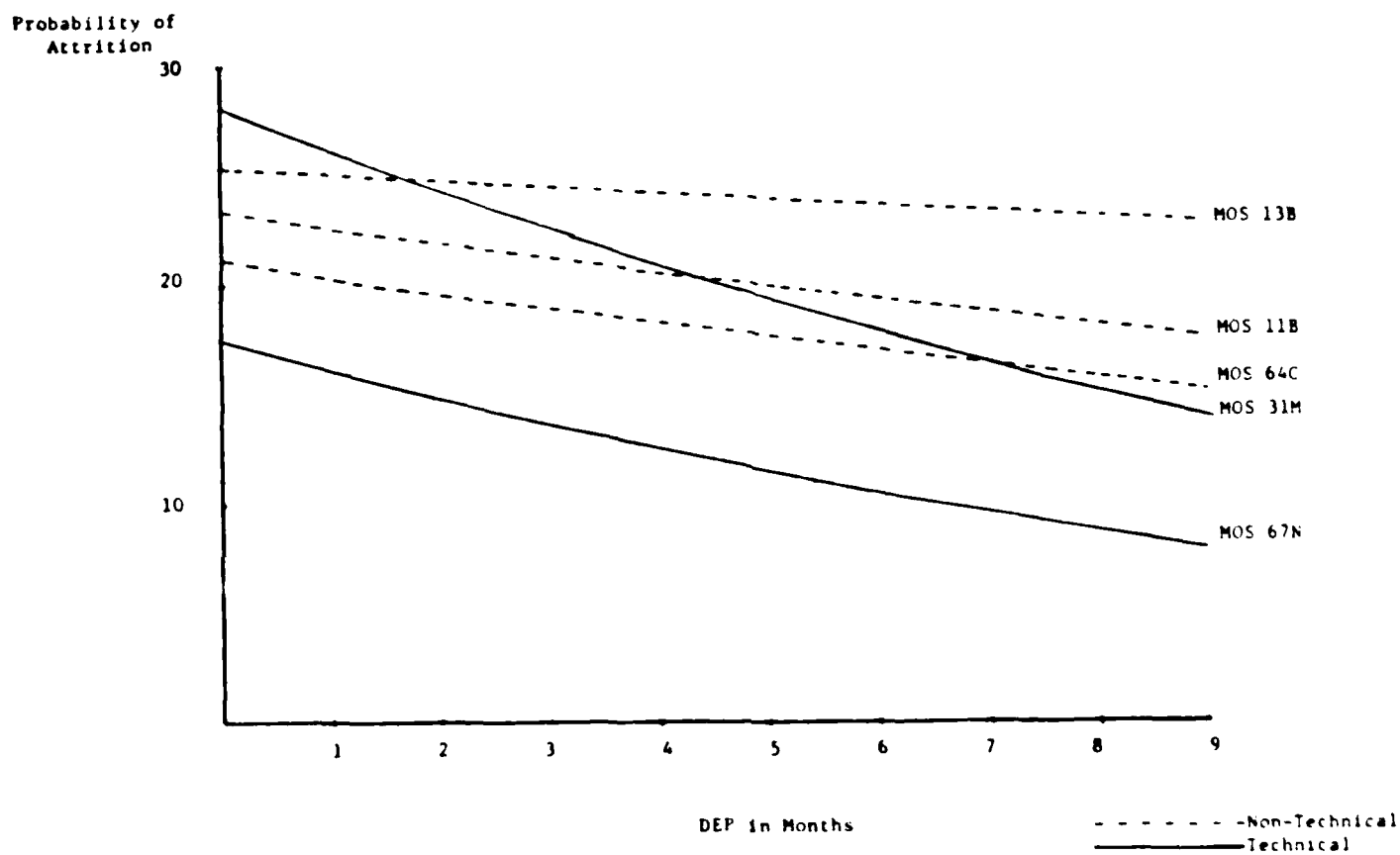


table. For example, MOS 05C (Radio Teletype Operator) and MOS 71L (Administrative Specialist) have similar probabilities at AFQT score of 50, .246 and .244, respectively. But at a score of 90, they have probabilities of .199 and .116, respectively. This demonstrates that MOS 71L exhibits greater sensitivity to changes in AFQT score than does MOS 05C. Buddin (1980) did not find AFQT score to be a significant factor except in Army combat arms MOS, where lower AFQT groups exhibited higher attrition. In Flyer and Elster (1983) AFQT varied as a significant determinant of attrition. Baldwin, Daula and Fagan (1981), in an Army specific study, found that the higher the test score the longer the individual was predicted to stay in their first term.

Education (Graduates, GED and Non-graduates)

Other research has found that high school degree graduates are more likely to complete their first term of service when compared to non-graduates. This analysis draws the same conclusion with the notable exception of general equivalency diplomas (GED). Those with a GED have a probability of attrition between graduates and non-graduates, or, a probability not significantly different from a high school graduate. This is an important finding particularly if recruiting of high school graduates becomes increasingly difficult and more GEDs are recruited.

Gender

All previously cited research concludes that females have a higher probability of attrition (or decreased survival time) than males. This research draws similar conclusions. (Some research has addressed why there are differences in attrition by gender. Reasons for differences in attrition by sex have been attributed to demographic differences, role ambiguity in non-traditional occupations and differential physical demands among occupations (Nogami 1984 page 1). The reason for behavioral differences is not central to this research, but has been addressed by Nogami and others.

Race and Ethnic Findings

Buddin showed that blacks have lower attrition in Army combat MOS (Buddin 1981 page vi). Flyer and Elster (1983) found that the Army was the only branch of the service in which blacks have lower attrition than whites. Otherwise, Flyer and Elster found that blacks had higher attrition overall. Baldwin, Daula and Fagan (1981) found non-whites have a longer survival time than whites in all MOS analyzed.

In 9 of the 13 of the MOS analyzed this research found blacks to have significantly lower attrition than whites. Hispanics were found to have lower attrition in some MOS (05C, 11B, 13B, 76Y) than whites. The attrition behavior of hispanics seems to lie somewhere between blacks and whites. (The Cohort data file used Spanish surnames to determine whether an individual was hispanic. This approach of using surnames may create a heterogeneous group which is difficult to characterize.)

In this research the category black females was included. This variable was significant in only 4 out of 10 equations. However, all significant and most insignificant elasticities show that black females have a lower probability of attrition when compared to white females.

VI. CONCLUSIONS

This section examines the implications of this research for:

- o Recruiting Policies
- o Allocation Policies
- o Further Research

Recruiting Policy

The findings presented in this research, along with results discussed in the background section, indicate that participation in the DEP decreases first term attrition of enlisted personnel. More specifically, this research demonstrates that as the length of the DEP increases the probability of

attrition decreases. With decreased attrition comes decreased first term costs. While sensitivity to DEP participation varies by MOS increasing average DEP length will produce substantial savings in training costs. A conservative estimate, among non-prior service high school graduates alone, shows that a 5 percent increase in average DEP length would produce a savings of about 9 million dollars. Appendix C shows how this estimate was derived.

On the recruiting side, the longer an individual is in the DEP, the more costly they become. This increased cost is due to increased recruiting effort. There is an opportunity cost to the recruiter since, the more time a recruiter spends following up on those in the DEP the less time that can be allocated to recruiting. Therefore, recommending a specific course of action becomes a more complex task.

Allocation Policy

Although not explicitly addressed here, an personnel system must consider the process of matching people to jobs. The "better" individuals are matched to jobs, based upon personal characteristics and job requirements, the more likely they are to perform well. Soldiers who perform well will be more effective and less costly. Part of the problem of examining allocation systems is the availability of accurate performance and attrition measures. This research, and previous research by the authors, has attempted to determine whether there are attrition differences in the type of job (MOS) people are assigned to. Do different individuals vary with respect to attrition behavior in the same MOS? Table 9 shows that MOS 71L (Administrative Specialist) is more sensitive to changes in AFQT score than is MOS 05C (Radio Teletype Operator). Table 6 shows that MOS 94B (Food Service Specialist) has a larger elasticity (.129) than does MOS 91B (Medical Specialist) (.038), with respect to assigning a non-graduate. Since data on both AFQT score and level of education are available at the time of enlistment (job assignment) this information can be used to assign people in a more sagacious manner.

Further Policy Findings

Findings concerning gender, ethnic and race differences have limited policy implications. Research by Nogami (1984) has investigated why there are differences in the level of attrition by gender. If, for example, women have higher attrition due to problems in performing in non-traditional roles, steps may be taken to reduce this. However, with respect to enlistment and allocation policies, this kind of information could be considered improper to use to make policy decisions. Also with respect to race and ethnic characteristics one would not want to base allocation decisions (who gets what job) on these! However any information that is accurate may be considered new knowledge which is both necessary and important.

What can be done in the area of gender and race differences is restricted to investigative causal analysis. Future analysis may examine whether blacks have lower attrition due to limited opportunities in the market place (private sector) when compared to whites, or, why do women have a higher probability of attrition.

These are legitimate research questions that should be addressed within the body of military personnel research.

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APPENDIX A
COHORT 81 MICRO-DATABASE SUBFILE

Name: Save1.FY981
Number of Observations: 87,084

<u>Variable Description</u>	<u>Type</u>
Age - in Years	Numeric
AGROUP - AFQT Continuous 0-99	Numeric
Bonus - Dollar value of Bonus	Numeric
DEPM - Months Enlistee was in the DEP	Numeric
DOD 1 - Primary (Training) Occupation	Numeric
DOD 2 - Secondary (Duty) Occupation	Numeric
EDUCA - Education Categorical	Character
GRADE - Grade at Accession Point	Numeric
ISC 1 - Inter Service Separation Code	Numeric
MARR - Marital Status	Character
MSTAT - Marital Status and Number of Dependents	Character
Option - Enlistment Option	Character
Prior - Prior or Non Prior Service	Numeric
Race - White, Black, Hispanic, Malaysian	Character
Region - Region of the Country	Character
Serv - Service (All Army)	Numeric
Sex - Male, Female	Character
Term - Term of Enlistment (1 through 6)	Numeric
Test - ASVAB Test (8 th , 9 th , and 10 th only)	Numeric

APPENDIX B
MOS 05C

AVERAGE AFQT SCORE	54.2
Average Time in DEP (Months)	2.12
Percent I-III A	41.27
Percent Hispanic	3.6
Black	29.0
White	67.4
Percent Female	16.8
Percent High School Graduate	74.6
Non-High School	20.0
GED	5.4
<hr/>	
Total Observations	3235
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MOS 11B

AVERAGE AFQT SCORE	49.3
Average Time in DEP (Months)	1.8
Percent I-III A	52.5
Percent Hispanic	3.9
Black	17.8
White	78.3
Percent High School Graduate	73.7
Non-High School	19.4
GED	6.9
<hr/>	
Total Observations	10449
<hr/>	

MOS 13B

AVERAGE AFQT SCORE	40.9
Average Time in DEP (Months)	2.0
Percent I-III A	68.9
Percent Hispanic	5.2
Black	34.7
White	60.1
Percent High School Graduate	75.2
Non-High School	19.1
GED	5.7

Total Observations	4081
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MOS 16J

AVERAGE AFQT SCORE	57.0
Average Time in DEP (Months)	1.5
Percent I-III A	35.3
Percent Hispanic	2.9
Black	17.8
White	79.3
Percent Female	7.6
Percent High School Graduate	64.1
Non-High School	16.8
GED	19.1

Total Observations	536
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MOS 31M

AVERAGE AFQT SCORE	52.4
Average Time in DEP (Months)	1.8
Percent I-III A	45.2
Percent Hispanic	3.3
Black	27.7
White	69.0
Percent Female	31.4
Percent High School Graduate	71.2
Non-High School	22.1
GED	6.7

Total Observations 1662

MOS 64C

AVERAGE AFQT SCORE	41.0
Average Time in DEP (Months)	2.1
Percent I-III A	69.4
Percent Hispanic	2.7
Black	19.3
White	78.0
Percent Female	15.3
Percent High School Graduate	73.9
Non-High School	18.1
GED	8.0

Total Observations 3628

MOS 67N

AVERAGE AFQT SCORE	6.3
Average Time in DEP (Months)	3.1
Percent I-III A	27.7
Percent Hispanic	3.1
Black	5.4
White	91.5
Percent Female	2.9
Percent High School Graduate	82.7
Non-High School	10.6
GED	6.7

Total Observations	1293
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MOS 71L

AVERAGE AFQT SCORE	49.6
Average Time in DEP (Months)	2.0
Percent I-III A	53.4
Percent Hispanic	3.8
Black	41.8
White	54.4
Percent Female	60.7
Percent High School Graduate	90.8
Non-High School	3.9
GED	5.3

Total Observations	3076
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MOS 76P

AVERAGE AFQT SCORE	32.6
Average Time in DEP (Months)	2.6
Percent I-III A	86.2
Percent Hispanic	6.2
Black	57.6
White	36.2
Percent Female	29.0
Percent High School Graduate	84.4
Non-High School	9.9
GED	5.7

Total Observations 4612

MOS 76Y

AVERAGE AFQT SCORE	42.3
Average Time in DEP (Months)	1.9
Percent I-III A	68.5
Percent Hispanic	5.2
Black	44.7
White	50.1
Percent High School Graduate	75.0
Non-High School	18.8
GED	6.2

Total Observations 3606

MOS 91B

AVERAGE AFQT SCORE	57.6
Average Time in DEP (Months)	2.4
Percent I-III A	35.0
Percent Hispanic	4.1
Black	24.2
White	71.7
Percent Female	26.0
Percent High School Graduate	84.9
Non-High School	6.0
GED	9.1
<hr/>	
Total Observations	2450

MOS 94B

AVERAGE AFQT SCORE	41.7
Average Time in DEP (Months)	1.6
Percent I-III A	70.4
Percent Hispanic	2.9
Black	33.7
White	63.4
Percent Female	18.1
Percent High School Graduate	62.4
Non-High School	28.9
GED	8.7
<hr/>	
Total Observations	2984

MOS 95B

AVERAGE AFQT SCORE	61.9
Average Time in DEP (Months)	2.6
Percent I-IIIA	23.9
Percent Hispanic	2.1
Black	6.7
White	91.2
Percent Female	10.9
Percent High School Graduate	88.2
Non-High School	7.9
GED	3.9

Total Observations	2770
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APPENDIX C

FY 1983 - ESTIMATED SAVINGS CALCULATION

Typical variable cost to train a soldier	= \$23,500*
Typical two year attrition rate	= 24.1%
Number of N.P.S. High School Graduate Male	= 99,726
Average elasticity of DEP found in research	= -.185

If the DEP is lengthened by 5% typical two year attrition will be	= 23.8%
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Lost cost due to attrition with 24.1% attrition

23,500 (99,726) .241	= 566,500,000
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Cost/Soldier NPS HSDG Typical Attrition

Lost cost due to Attrition with 23.8% Attrition

23,500 (99,726) .238	= 557,770,000
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(Savings) 566,500,000 - 557,770,000 = \$8,730,000

- * Cost Estimates made from Military Occupational Specialty Training Cost Handbook, October 1983. Cost Analysis Division, U.S. Army Finance & Accounting Center.